SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION
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TO: Commissioners and Alternates

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SUBJECT: Staff Report on the Primary Issues Associated with Restoration of the South Bay Salt Ponds
(For Commission consideration on March 18, 2004)

Summary

Outlined below are the primary issues associated with restoring the South Bay salt ponds, the discussion of which will strongly influence and inform decisions made on a restoration plan for the former Cargill Division salt ponds. These issues include: (1) salt pond elevations and natural sediment supply; (2) possible use of clean, dredged sediment to increase the rate of restoration; (3) hydrologic and existing infrastructure constraints to restoration; (4) flood protection; (5) adaptive management; (6) determinations on the ultimate habitat composition for each pond (i.e., tidal marsh versus managed ponds); (7) control of non-native species; (8) water quality; (9) public access and wildlife; and (10) mosquito abatement. Important restoration issues discussed in this report will be addressed in greater detail as part of the update of the *San Francisco Bay Plan* salt pond policies scheduled for Commission consideration in FY 04-05. The *South Bay Salt Pond Initial Stewardship Plan* will be reviewed by the Commission this April, with the *Final Restoration Plan* expected to be before the Commission in 2006.

Staff Report

In March 2003, 16,500 acres of South Bay salt ponds were purchased by the state and federal government. The California Department of Fish and Game (DFG) and U.S. Fish and Wildlife Service (USFWS) are responsible for managing the salt ponds purchased. Salt ponds provide important and unique habitat for a diversity of fish, other aquatic organisms, and wildlife associated with San Francisco Bay. Salt ponds provide habitat of international significance to shorebirds and waterfowl. In addition, salt ponds provide not only important habitat, but their large surface area supplements the water surface of the Bay and thus helps to moderate the Bay Area climate and to prevent smog.

The restoration of the salt ponds provides an opportunity to improve the well-being of a number of Bay plant and animal species at risk of extinction and to enhance habitat for resident and migratory fish, plant, and wildlife species. A number of issues associated with restoration of the South Bay salt ponds will influence the decisions made on a restoration plan, including:

1. **Salt Pond Elevations and Natural Sediment Supply.**[1] The restoration of a managed salt pond to a tidal marsh depends on the ability of tidal marsh plants to colonize ponds opened to the tide. Because tidal marsh plants have varying tolerances to periods of submergence, different tidal marsh plant species only grow in specific "zones," typically correlated with elevation. Thus, the elevation of the bottom of a pond, once the surrounding levee is breached, in relationship to the height of incoming tidal waters, will determine what plants can successfully colonize a pond. More specifically, low marsh vegetation, such as Pacific cordgrass, typically grows from approximately mean tide level (MTL) to approximately mean high water (MHW), the marsh plain, typically dominated by pickleweed, is normally found from MHW to mean higher high water (MHHW), while high marsh species, such as marsh rosemary and salt grass are normally found above MHHW.

   A review of the bottom elevations of the South Bay's salt ponds[2] shows that most South Bay salt pond bottom elevations are between MTL and MHW (15,930 acres or 61 percent of the salt ponds). In these ponds, colonization by low marsh species (i.e., cordgrass) should occur during restoration with relative rapidity. On the other hand, ponds from Mountain View east to San Jose are significantly subsided, due to groundwater withdrawal and aquifer overdraft between 1912 and 1969. Most of the ponds in this region are between mean low water (MLW) and MTL (5,790 acres or 22 percent of the salt ponds). These pond bottoms are anywhere from six to eight feet below elevations needed to support tidal marsh. Thus, the bottom elevations of salt ponds may strongly influence approaches to restoring tidal action to the ponds. For example, it may be decided to use many of the deeper ponds to create open water areas or to use fill or dredged material to raise pond elevations, or to dampen or restrict the amount of tidal action introduced into the ponds.

   To a great extent, improving a pond's tidal marsh restoration success rate entails an adequate supply of sediment to raise the elevation of the pond to a level where vegetation can grow. Important to consider is that simply opening the ponds to tidal influence may significantly affect the South Bay's tidal flats, as the subsided ponds may act as sediment sinks where sediment taken from surrounding tidal flats by the tides will be deposited. In addition, a restoration project on the scale of that proposed in the South Bay has the potential to significantly affect the sediment dynamics of the Bay as a whole. In particular, scientists now believe that the sediment delivered to the Bay from the Delta and surrounding watersheds is a limited resource, especially in light of increasing restoration projects which trap sediment coupled with the effects of relative sea level rise, the reduced amount of sediment available may significantly affect the time needed before sufficient sediment has accreted to support marsh vegetation. For this reason, greater scientific research attention should be dedicated to better understanding:[3] (1) Bay-wide sediment dynamics and the sediment budget for the South Bay; and (2) the potential role of the restoration of the salt ponds on the South Bay sediment budget and Bay-wide sediment dynamics.[4]

2. **Use of Fill for Restoration.** Using dredged sediment can accelerate the colonization of tidal marsh habitat in a restored salt pond. Without the placement of dredged material, under a natural sedimentation approach, high tidal marsh habitat can take many years to restore naturally because the rate of sedimentation in a tidal marsh decreases as ele-

[1] This section is adapted from Siegel and Bachand, 2002.
[2] This characterization of the elevation of the salt ponds in the South Bay does not include ponds owned by Cargill in Newark as no information is available.
[3] This need was discussed on September 16, 2003 by the South Bay salt pond regulatory and trustee agency meeting participants helping to plan the long term restoration of the ponds.
[4] For more information on Bay sediment and the relationship to restoration projects see Philip B. Williams article entitled "Is There Enough Sediment" in *Science and Strategies for Restoration,* a compilation of proceedings from the October 2001, State of the Estuary. Published by the San Francisco Estuary Project and Calfed.

vation increases. In addition, importing the material would more likely ensure protection of the South Bay tidal flats because the restored ponds would not act as a sediment sink. However, determining how to place dredged sediment into a target salt pond with the least amount of environmental impact would also be necessary, as well as determining how to protect the structure and form of historic tidal channels located throughout the salt ponds when placing dredged material (see discussion below).

The McAteer-Petris Act allows the Commission to authorize fill in salt ponds. However, the Commission would have to determine the amount of fill permissible based on the McAteer-Petris Act and Bay Plan policies. In other valuable natural resource areas, such as tidal marshes, tidal flats and wildlife refuges, the Commission specifies in the Bay Plan that the placement of a minor amount of fill for enhancement or restoration is permissible.

3. **Hydrologic and Existing Infrastructure Constraints to Restoration.**[5] Three important geographic considerations can affect the feasibility of and approach to restoring a salt pond including:

   a. **Existence of Historical Channel Networks.** Historic channel networks are those channels which once transported water, sediments, nutrients and biological organisms into and out of a particular tidal marsh before it was diked and subsequently turned into a salt pond. The presence of historic provides a template for restoration and has been a physical feature that has been utilized in past restoration of salt ponds. While the crystallizer ponds do not have historic channel networks because of a substantial amount of grading during salt harvest, most other salt ponds do have channels. For this reason, historic channel networks should be considered an important asset in the planning for the restoration of many of the salt ponds to tidal marsh.

   b. **Hydrologic Connection to the Bay.** A pond's hydrologic connection to the Bay determines the ease with which tidal action can be brought to a pond proposed for restoration to tidal marsh. Those ponds deemed most feasible for restoration to tidal marsh are those whose edges fronts directly onto the Bay or onto a large tidal channel. On the other hand, those ponds most difficult to restore have no direct access to the Bay or only have access to a small tidal channel which would need to be enlarged to allow for sufficient water to flood and drain completely with the tides. In addition, the presence of tidal marsh outboard of the salt pond levee can restrict how much tidal action will occur when pond levees are initially breached. Thus, in developing restoration plans, planners will be evaluating the need to: (1) mechanically excavate a channel through the marsh; (2) allow natural erosive forces to excavate the channel; or (3) relocate the connection channel to a place in the levee where little or no outboard tidal marsh exists. Consequently, proximity to the tides may determine whether or not a pond is restored to tidal marsh or enhanced to become a pond managed for the benefit of shorebirds and waterfowl.

   c. **Presence of Infrastructure.** The presence of infrastructure, including storm drain systems, roads and rail, petroleum pipelines, fiber optic cables, electrical transmission lines, natural gas pipelines, historic structures, and sewer structures may prove to be a significant impediment to restoration efforts. For example, below-ground pipelines may lie at elevations that would partially or wholly block tidal exchange into a pond proposed for restoration. For this reason, adequate mapping, planning and coordination with those entities responsible for the infrastructure must occur throughout the restoration of the salt ponds.

[5] This section is adapted from Siegel and Bachand, 2002.

4. **Flood Protection.** Aside from publicly maintained flood control levees bordering a few ponds, the levees associated with the salt pond operating system are not constructed to meet modern flood control engineering requirements. The U.S. Army Corps of Engineers and the Santa Clara Valley Water District recognize that the flood protection needs of the South Bay will change significantly with alterations in the Bay's hydrology associated with opening many of the publicly owned ponds to tidal influence.[6] In particular, as tidal influence is introduced to the ponds through levee breaches, flood control will shift from bayward levees to inland levees. A significant portion of the ponds have an upland edge that depends on external bayward levees for flood protection, because the inland levees lack the ability to perform flood control functions. Therefore, substantial engineering improvements in inland levees and ongoing maintenance will be required to protect the South Bay from tidal flooding associated with restoration. To date, funding for a study to examine necessary modifications to flood protection levees has not been provided to the U.S. Army Corps of Engineers by Congress.

5. **Adaptive Management.** Adaptive management incorporates information learned from creation, restoration, enhancement, or management of habitat into subsequent decisions regarding habitat management. To date, adaptive management has been used to solve problems in large, complex natural systems, such as the restoration of the Everglades and the recovery of salmon in the Columbia River. Due to the adaptive management approaches' strength in helping to solve complex and large scale natural resource dilemmas, it undoubtedly will be incorporated throughout the salt pond restoration process.

6. **Habitat Composition.** Because different kinds of species are dependent upon different kinds of habitats, the composition of the habitats restored and enhanced in the South Bay will directly affect the diversity, abundance and distribution of fish, other aquatic organisms and wildlife. The restoration approach will be informed by the *Baylands Ecosystem Habitat Goals* report (Goals Report) and recovery plans for endangered species that outline habitat needs. A primary focus of the long-term restoration planning process for the salt ponds is reaching consensus on the balance between areas restored to managed ponds and areas restored to tidal marsh and tidal flat. Managed ponds have high value for shorebirds and waterfowl, both year-round residents and those wintering in San Francisco Bay, while tidal marshes and tidal flats provide critical habitat for sensitive native bird species, such as the saltmarsh common yellowthroat, Alameda song sparrow, the California clapper rail, and the endangered salt marsh harvest mouse. In addition, an examination of the regional needs of fish, other aquatic organisms, and wildlife associated with the South Bay will need to consider not only the habitat opportunities presented by the publicly acquired salt ponds, but also the ponds under continued management and ownership by Cargill. Ongoing coordination with Cargill should ensure that an understanding of the habitat values provided by privately-held ponds are incorporated into the vision for the long-term restoration of the publicly owned ponds. For example, more of the publicly acquired salt ponds are restored to tidal influence, the remaining privately managed ponds may be of even greater importance to species that rely on shallow salt pond environments.[7]

7. **Non-Native Species.** Those species not historically found in the Bay and known as non-native or invasive species are currently considered a primary threat to the Bay's biological diversity (biodiversity). Over 170 non-native species now inhabit the Bay. These species can crowd out native species, prey upon them, and alter their habitats. All of the Bay's habitats have been affected by invasive species. One non-native plant species in particular has the potential to significantly affect salt pond restoration efforts. Smooth cordgrass, known as *Spartina alterniflora,* is native to Atlantic coast tidal marshes. Unlike *Spartina foliosa*, the native cordgrass species, smooth cordgrass lives over a wider

[6]Kendall, Thomas. 2003. Personal Interview with Chief, Planning Branch, U.S. Army Corps of Engineers.
[7] Siegel and Bachand, 2002.

range of tidal elevations and colonizes tidal mudflats, marsh pans, and the banks of small tidal creeks and ditches.[8] This colonization of previously unvegetated areas eliminates the "sinuous, branched sloughs and mosaics of pans" which provides foraging habitat for the California clapper rail and other species and which uniquely define native San Francisco Bay tidal marshes from the more homogeneous "poorly-drained extensive marsh plains" of Atlantic coast salt marshes.[9] Also, smooth cordgrass grows on the same tidal mudflats which, in their unvegetated state, provide foraging habitat for over one million migratory shorebirds passing through the estuary annually. Smooth cordgrass is highly invasive and also can breed with native cordgrass, resulting in invasive hybrids.

The Bay region containing the greatest amount of non-native smooth cordgrass, approximately 75 percent of the estuary's total, is in the South Bay between the San Mateo Bridge and the Dumbarton Bridge, totaling 350 acres. Thus, non-native smooth cordgrass has the potential to profoundly affect salt pond restoration goals and objectives, especially in the South Bay, due to possible colonization of areas opened to the tides.[10] Therefore, many scientists believe that the restoration of salt ponds close to existing stands of smooth cordgrass should be undertaken cautiously.[11] In addition, the long term restoration of the salt ponds should be done in coordination with the Coastal Conservancy's Spartina Control Program, which is initiating efforts to control non-native cordgrass species throughout the Bay.[12]

8. **Beneficial Reuse of Treated Wastewater.** Recycled water from wastewater treatment plants can be a valuable source of freshwater for the desalination[13] of salt ponds in the process of restoration.[14] For example, in the Napa River Salt Marsh Restoration Project, a combined 6,000-7,000 acre-feet per year of recycled water is proposed to be provided by the Sonoma Valley County Sanitation District, the Napa Sanitation District, and the City of American Canyon for salinity reduction in the high salinity upper ponds (Ponds 7, 7A and 8).[15] Similarly, the San Jose/Santa Clara Water Pollution Control Plant could provide a source of water for salinity reduction of the South Bay salt ponds. Currently, only 10% of the plant's daily capacity of 167 million gallons is recycled for landscaping, agricultural irrigation, and industrial needs.[16] Too much influx of fresh water (i.e., if it does not mix sufficiently with salt water) can also change the species composition of receiving waters, and so must be evaluated carefully.

9. **Water Quality.** A number of water quality considerations exist in the planning process for the restoration of the salt ponds. Those water quality issues of greatest concern include:

   a. **Mercury Methylation.** Mercury is a naturally occurring heavy metal found throughout the Coast Range of California in an elemental form known as cinnabar. In fact, the California Coast Range contains one of the world's greatest geologic deposits of mercury. Mercury was mined extensively from the Coast Range during the late 1800s and early 1900s and used to supply Gold Rush era gold mining in the Sierra Nevada

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[8] San Francisco Estuary Invasive Spartina Project: Invasion Impacts. (http://www.spartina.org/invasion.htm#6)
[9] Baye, Peter. 2002. *Plant Species in Decline in the S.F. Bay Estuary.* San Francisco Estuary Project and Calfed. State of the Estuary Proceedings, October 2001.
[10] Baye, Peter. 2002. *Plant Species in Decline in the S.F. Bay Estuary.* San Francisco Estuary Project and Calfed. State of the Estuary Proceedings, October 2001. & San Francisco Estuary Invasive Spartina Project: Invasion Impacts. (http://www.spartina.org/invasion.htm#6)
[11] Siegel and Bachand, 2002.
[12] South Bay Salt Pond Restoration Project: Frequently Asked Questions. (http://www.southbayrestoration.org/sbsp_faq.html)
[13] "Process of reducing salt pond salinity to acceptable levels." Siegel and Bachand, 2002.
[14] Goals Project, 1999 & Siegel and Bachand, 2002.
[15] Jones and Stokes. 2003.
[16] Environmental Services, City of San Jose—Capital of Silicon Valley: San Jose/Santa Clara Water Pollution Control Plant; About the Plant. (http://www.ci.san-jose.ca.us/esd/wpcp.htm)

with material needed for the gold extraction process.[17] A concern with plans to restore many of the salt ponds to tidal marsh is the effect that this restoration process will have on the creation of methylmercury, an organic form[18] of mercury. Mercury can undergo biological and chemical reactions that cause it to change form and alter its solubility, toxicity and bioavailability. Methylmercury is the most toxic form of mercury to animals and humans because it transfers between organisms through the food web and magnifies in concentration.[19]

In an aquatic environment the methylation of mercury can occur in the sediment and the water column.[20] Wetlands are methylating environments and methylmercury production is greatest in brackish environments, such as tidal marshes and sloughs.[21] Regulatory efforts are underway to address mercury in the Bay. Section 303(d) of the federal Clean Water Act requires states to compile a list of "impaired" water bodies that do not meet water quality standards for specific contaminants, such as mercury.[22] All of San Francisco Bay is deemed to be impaired by mercury because it adversely impacts established beneficial uses, including sport fishing, preservation of rare and endangered species, and wildlife habitat.[23] Accordingly, a cleanup plan, known as a Total Maximum Daily Load Project Report (TMDL), was completed in June 2003 for mercury by the San Francisco Bay Regional Water Quality Control Board (Regional Board). Also, because a substantial proportion of the mercury found in the South Bay arrives from upstream sources in the Guadalupe River, a separate subset TMDL effort has been initiated by the Regional Board and the Santa Clara Valley Water District for cleaning up the Guadalupe River Watershed.[24] Currently, 7% of the Bay's total mercury inputs, or approximately 92 kg/year, enter the Bay from the Guadalupe River watershed. Once implemented, the TMDL for the Guadalupe River will decrease permissible loads of mercury into the Bay from 92 kg/year to 1.7 kg/year.[25]

In terms of salt pond restoration, Regional Board staff emphasizes the need to define Best Management Practices for the restoration of the salt ponds to prevent methylation of mercury when the ponds are opened to tidal influence in the highly contaminated South Bay. Physical factors which can be manipulated during restoration as a means to reduce the production of methylmercury in the Bay's wetlands include: (1) degree of inundation; (2) salinity; (3) vegetation; and (4) source sediment.[26] In summary, measures to "identify and evaluate potential landscape management approaches for reducing the production and abundance of methylmercury in the ecosystem, as well as the associated exposure of resident biota" remain largely untested, but needed.[27]

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[17] Jones, Alan B. and Darrell G. Slotten. 1996. *Mercury Effects, Sources, and Control Measures.* San Francisco Estuary Institute, Regional Monitoring Program Contribution #20. (http://www.sfei.org/rmp/reports/mercury/mercury.html)

[18] "Organic" in this instance means "derived from living organisms." More specifically, the transformation of inorganic mercury to organic methylmercury is powered largely by sulfate-reducing bacteria active at the interface of water high in oxygen and water low in oxygen, and in sediment and wetlands.

[19] Calfed Bay-Delta Program. 2000. Water Quality Program Plan: *Mercury.*

[20] Calfed Bay-Delta Program, 2000.

[21] California Regional Water Quality Control Board San Francisco Bay Region, 2000 & Presentation by James G. Wiener, University of Wisconsin-La Crosse, at U.S.EPA. 2003.

[22] San Francisco Estuary Institute (SFEI), 2003.

[23] California Regional Water Quality Control Board San Francisco Bay Region, 2003.

[24] Fiedler, Jim. 2003. Personal interview with the Chief of the Watershed Management Division at the Santa Clara Valley Water District.

[25] California Regional Water Quality Control Board San Francisco Bay Region, 2003.

[26] California Regional Water Quality Control Board San Francisco Bay Region, 2000.

[27] Weiner, James G., Cynthia C. Gilmour and David P. Krabbenhoft, 2003 & Presentation by James G. Wiener, University of Wisconsin-La Crosse, at U.S.EPA. 2003.

b. **Copper and Nickel.**[28] The State Water Resources Control Board no longer considers copper and nickel as contaminants of concern in the Estuary, except at the mouth of the Petaluma River.[29] However, the process of making salt through the solar evaporation of Bay water concentrates Bay pollutants (e.g. copper and nickel) in the ponds proportionately with salinity. Therefore, higher salinity ponds (above 50 ppt) contain levels of pollutants in excess of water quality objectives for the Bay. As a result, the Regional Board will likely have to limit the discharge of brines from salt ponds to the Bay in a manner which assures the appropriate dilution of brines before release to the Bay, so as not to exceed water quality objectives for copper and nickel.

c. **Gypsum.**[30] During the salt production process, between the salinities of 147 parts per thousand (ppt) and 312 ppt, calcium sulfate (gypsum) precipitates out of solution and can form a hard, relatively insoluble layer on the bottom of salt ponds. Gypsum precipitation is rather patchy and often occurs around fibrous vegetation material. Because it may hinder tidal channel formation, sediment redistribution and plant colonization, thereby slowing marsh restoration, gypsum is an impediment to restoration which should be considered in the planning process. In particular, the extent to which gypsum can impede tidal marsh restoration is largely a function of pond elevation. In lower elevation ponds in which sediment accretion is expected, Bay sediment will bury the gypsum layer and its presence will likely negligibly affect restoration efforts. However, in mid elevation ponds in which initial pond elevations are closer to target marsh elevations, and especially those in which the crust is more consolidated and uniform, gypsum may persist for over 50 years and may greatly impede restoration. Further, gypsum deposits remain intact seemingly indefinitely in areas not subject to regular tidal action and with only intermittent rainfall.

d. **Brine Management.** Planning for the salinity reduction of brines (hypersaline water) in the salt pond system is a primary focus of the restoration effort. The salinity of the Bay can range widely from 15-35 ppt, due to freshwater inflow from the Delta and tidal influence from the Pacific Ocean.[31] Above 35 ppt, salinity quickly becomes toxic to marine organisms. For example, a study undertaken in the 1990s by municipalities in California proposing to desalinate ocean water for drinking water found that sea urchins were impacted by salinities of 38 ppt and kelp was affected by salinities of 43 ppt.[32] Similar impacts on estuarine organisms are expected in the Bay.

e. **Water Quality Implications of Habitat Types.** Restoring salt ponds to managed ponds requires careful water management to prevent stagnation, the production of algae blooms, and the precipitation of salts.[33] On the other hand, tidal marshes and tidal flats have the capacity to improve water quality, rather than potentially exacerbate water quality problems. Tidal habitats can improve water quality by filtering nutrients, organic particles and sediment carried by runoff from surrounding land. Many chemicals, such as fertilizers, human and household wastes, and toxic compounds are tied to sediments that can be trapped in tidal marshes.[34] Some pollutants may remain buried, while others may be taken up by tidal marsh plants and either recy-

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[28] Adapted from: Letter from Steve Moore of the San Francisco Bay Regional Water Quality Control Board to Al Wright of the California Department of Fish and Game Wildlife Conservation Board. January 9, 2003. "Review of Data from Cargill Salt Ponds, South San Francisco Bay."
[29] San Francisco Estuary Institute (SFEI), 2003.
[30] This section is adapted from "Siegel and Bachand, 2002."
[31] Siegel and Bachand, 2002.
[32] Moore, Steve. 2003. Personal interview with Chief of Policy and Planning Division of the San Francisco Bay Regional Water Quality Control Board.
[33] Moore, Steve. 2003. Personal interview with Chief of Policy and Planning Division of the San Francisco Bay Regional Water Quality Control Board.
[34] Steere, J.T. and N. Schaefer. 2001. *Restoring the Estuary: Implementation Strategy of the San Francisco Bay Joint Venture*. San Francisco Bay Joint Venture, Oakland, California.

cled within the marsh or transported from it.[35] Further, plants and biological processes in tidal marshes can break down and convert pollutants into less harmful substances. In addition, tidal marshes and tidal flats provide a vital connection to the Bay's aquatic food web. For example, when tidal marsh plants die back in the fall and winter, up to 70 percent of the plant material is broken down into small particles and released into the Bay on the tides. Once in the Bay, this plant material provides a wealth of food to estuarine-dependent fish and other aquatic organisms. Restoring salt ponds to tidal influence in the South Bay will greatly improve this previously significant food web connection to the Bay. Currently, due to diking, flood control and toxic pollutants, the South Bay's most important source of primary productivity[36] has shifted from tidal marshes to the annual spring phytoplankton bloom[37] in the water column.[38] Further, tidally influenced habitats, in contrast to managed ponds, are very resilient to natural variability, such as daily tides, annual floods, and less frequent droughts. On the other hand, managed ponds rely on continued operation and maintenance, through levees and other structures, to maintain their desired form and function.[39]

10. **Public Access and Wildlife.** In an effort to seek a balance between the need to provide public access to the Bay, while recognizing potential impacts on the Bay's natural environment associated with public access, in particular impacts to wildlife, the Commission initiated a study and adopted new Bay Plan findings and policies pertaining to public access and wildlife compatibility in 2001. In considering future siting, design, and management of public access in salt pond areas proposed for restoration, the following Bay Plan Public Access policies are of particular relevance to the Commission in considering salt pond restoration plans:

    - **Public Access Policy 3**—Public access to some natural areas should be provided to permit study and enjoyment of these areas. However, some wildlife are sensitive to human intrusion. For this reason, projects in such areas should be carefully evaluated in consultation with appropriate agencies to determine the appropriate location and type of access to be provided.

    - **Public Access Policy 4**—Public access should be sited, designed and managed to prevent significant adverse effects on wildlife. To the extent necessary to understand the potential effects of public access on wildlife, information on the species and habitats of a proposed project site should be provided, and the likely human use of the access area analyzed. In determining the potential for significant adverse effects (such as impacts on endangered species, impacts on breeding and foraging areas, or fragmentation of wildlife corridors), site specific information provided by the project applicant, the best available scientific evidence, and expert advice should be used. Siting, design and management strategies should be employed to avoid or minimize adverse effects on wildlife…

    - **Public Access Policy 6**—Public access improvements provided as a condition of any approval should be consistent with the project and the physical environment, including protection of Bay natural resources, such as aquatic life, wildlife and plant communities…

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[35] San Francisco Estuary Project. 1991. *Status and Trends Report on Wetlands and Related Habitats in the San Francisco Estuary.* Association of Bay Area Governments, Oakland, California.
[36] Amount of organic material, primarily plant material, available in an ecosystem as a food source for organisms higher up the food chain.
[37] Tiny plants, such as algae, which float in the Bay's waters and provide food to fish and other aquatic organisms.
[38] Moore, Steve. 2003. Personal interview with Chief of Policy and Planning Division of the San Francisco Bay Regional Water Quality Control Board.
[39] Reed, Denise J. 2003. Sustainability in Wetland Restoration: The Importance of Variability. Presented at 6th Biennial State of the Estuary Conference. October 21, 22, and 23. Oakland, California.

- **Public Access Policy 12**—Public access should be integrated early in the planning and design of Bay habitat restoration projects to maximize public access opportunities and to avoid significant adverse effects on wildlife.

Further, both land management agencies involved in the acquisition and restoration of the salt ponds—California Department of Fish and Game and the U.S. Fish and Wildlife Service—recognize the importance of providing public access compatible with the protection of wildlife.

Planning for the public access component of the long-term restoration phase of the salt ponds will occur over the next 5 years with substantial scientific and public input. Possible recreational uses of the restored and enhanced ponds include hiking trails, multipurpose hiking and biking trails, wildlife viewing, hunting, fishing and boating.[40] It is anticipated that trails that are currently open to the public will remain open. Parts of the property that are currently closed will likely remain closed until Cargill has completed Phase-Out of salt production. Once Cargill transfers operational responsibility to the Department of Fish and Game and the U.S. Fish and Wildlife Service, opportunities for groups to visit the newly acquired ponds during the initial stewardship phase may be possible as part of docent-led tours. Further, waterfowl hunting will continue to be allowed on some ponds, though not on a private lease system as was provided by Cargill historically. According to Marge Kolar, refuge manager for the Don Edwards San Francisco Bay National Wildlife Refuge, nearly 400 leases (e.g., for utilities) exist on former Cargill property that will eventually transfer to the public.[41]

Overall, the Commission's role in the planning process for the siting, design, and management of public access associated with the long term restoration of the salt ponds should include the following objectives: primary, multi-use, all weather public access should be provided on levees unlikely to be breached for restoration purposes and that are likely to be permanent on a long-term basis, where appropriate. Loop or point access trails and controlled access in certain areas should also be considered, as well as important connections from nearby communities. Commission staff should actively participate in the public access planning process for the long-term restoration of the salt ponds. It is important to integrate public access into the planning process as early as possible because design features can reduce or eliminate conflicts between public access and wildlife in many instances. Land-carried recreation boating opportunities, such as kayaking and canoeing, should be improved throughout the South Bay, while avoiding potential impacts to birds and marine mammals.

11. **Mosquito Abatement.** While the salt ponds used for salt production do not foster large mosquito populations, changes in water management regimes associated with habitat restoration may lead to a substantial increase if the ponds are managed improperly. A variety of species of mosquitoes are associated with the tidal and seasonal wetlands of the Bay, including the California salt marsh mosquito and the black salt marsh mosquito.[42] Because mosquitoes are vectors for disease, including West Nile Virus, the restoration of the salt ponds should be designed to minimize the production of mosquitos and incorporate plans for mosquito abatement. The primary goal of mosquito abatement is to keep mosquito populations below threshold levels for disease transmission to humans and to reduce nuisance problems that can impact recreational, economic and agricultural activities, as well as create public distress.[43] A critical component of

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[40] South Bay Salt Pond Restoration Project: Frequently Asked Questions. (http://www.southbayrestoration.org/sbsp_faq.html)
[41] Kolar, Marge. 2003. Personal Interview with Refuge Manager for the San Francisco Bay National Wildlife Refuge Complex.
[42] Contra Costa Mosquito & Vector Control District: Comparative Biology of Twenty-One Prevalent California Mosquito Species. (http://www.ccmvcd.dst.ca.us/california_mosquito_species.htm)
[43] Goals Project, 1999.

adequate abatement is ensuring that the restoration of the salt ponds incorporates input from local mosquito abatement districts on the design of wetland restoration and enhancement projects. In particular, tidal action is a good deterrent to increases in mosquito populations because water movement hinders mosquito reproduction. Further, appropriate design elements may include: (1) exposing an area to regular tidal action; (2) creating open water areas with little or no vegetation; (3) permanently flooding areas to provide habitat for mosquito predators; and (4) establishing a long fetch for the creation of waves.[44]

[44] Goals Project, 1999.